



## Syllabus for Astronomy 30

### Course Information

Semester & Year: Spring 23

Course ID & Section #: Astro 30 (E4477)

Instructor's name: Dr. Jon Pedicino

Day/Time/Location: Monday, 2:50-4:55 PM, Hum 129

Course units: 2.0

### Instructor Contact Information

Office hours: MW 9:00-10:00, Hum 209

Email address: [jon-pedicino@redwoods.edu](mailto:jon-pedicino@redwoods.edu)

### Catalog Description

A class examining and exploring science through science fiction films. Students will critically examine science fiction movies, distinguishing fact from fiction. Students will also explore the curious phenomenon of how science fiction can become science fact. The class will also examine the underlying science themes and their application to a range of social, cultural, and economic issues.

### Course Student Learning Outcomes *(from course outline of record)*

1. Identify fundamental scientific concepts.
2. Distinguish between science fiction and science fact.
3. Evaluate the accuracy of the portrayal of science and scientists in fictional texts, movies, or games.

### Grading

40%-Participation, 35%- (4-5)-Presentations (8-10 min each), 25%- Paper (5-7 pages)

A (>93.3%), A- (90-93.3%), B+ (86.7-89.9%), B (83.3-86.6%), B- (80-83.2%), C+ (76.7-79.9%), C (70-76.6%), D (55-69.9%), F (<55%)

### Accessibility

College of the Redwoods is committed to making reasonable accommodations for qualified students with disabilities. If you have a disability or believe you might benefit from disability-related services and accommodations, please contact your instructor or [Disability Services and Programs for Students](#) (DSPS). Students may make requests for alternative media by contacting DSPS based on their campus location:

- Eureka: 707-476-4280, student services building, 1<sup>st</sup> floor
- Del Norte: 707-465-2324, main building near library
- Klamath-Trinity: 530-625-4821 Ext 103

If you are taking online classes DSPS will email approved accommodations for distance education classes to your instructor. In the case of face-to-face instruction, please present your written accommodation request to your instructor at least one week before the needed accommodation so that necessary arrangements can be made. Last minute arrangements or post-test adjustments usually cannot be accommodated.

**Syllabus- Astronomy 30**  
ASTR 30, Humanities Room 129  
Monday 2:50-4:55 PM  
Spring Semester, 2023

Instructor: Dr. Jon Pedicino

Office: Hum 209

Phone: 476-4232, Email [jon-pedicino@redwoods.edu](mailto:jon-pedicino@redwoods.edu)

Office Hrs: **MW 9:00-10:00 AM**, by Appt.

Text: Movies, Reading as assigned from periodicals and the internet.

**Goals/Objectives**

1. Develop critical science thinking skills; explore and discover
2. Research/present a short discussion based on a specific film.
3. Explore the popular media and its role in transmitting the ideas of science.
4. Specifically, develop an understanding of the language and themes of astronomy as they relate to the birth and evolution of the solar system and the universe.
5. Develop insights into prevalent and pertinent issues in astronomy today.

**Learning Outcomes**

1. Identify fundamental scientific concepts.
2. Distinguish between science fiction and science fact.
3. Evaluate the accuracy of the portrayal of science and scientists in course material.

**Policies**

**Grading**

40%- Participation in class discussions

35%- (5) In-class presentations of specific science topic (8-10 min. each)

25%- Research paper (4-6 pgs) evaluating scientific value of a specific film

**Late work**

I do not accept late assignments without a very good reason. Please consult me if you have a problem, preferably before the assignment is due.

**Attendance/Participation**

In addition to daily attendance, I will note participation of the members that are present.

**Academic Integrity**

I work under the assumption that everyone is honest and trustworthy until proven otherwise. All of you deserve nothing less. However, if I find an instance of dishonesty, consequences will be quick and decisive. Interaction in science, and life for that matter, can exist on many levels. Only trust and honesty can lead to the open give and take that marks a healthy educational community.

**Extra Help**

I am always available for extra help. Please take the initiative to meet with me. We can find another time if the office hours don't work. If you have a medical condition or disability that I should be aware of, please let me know.

## Schedule/Outline

Monday, January 23 - First day of classes

Monday, February 20- **No class**

Monday, March 13- **No class (Spring break)**

Monday, May 1- Final class, Paper due by midnight, **Friday May 5**, on Canvas

Note: This class is designed to be taught in a seminar format, exploring a range of topics, the list of movies that follows is meant to give a sense of the breadth of discussion, subject to change.

### Film/Discussion

Monday, January 23

#### **Gravity**

Monday, January 30

Space Program, Space station, Tourism

Monday, February 6

#### **Star Trek 2: Into Darkness**

Monday, February 13

Genetic Engineer, Teleportation, Warp Drive

Monday, February 27

#### **Europa Report**

Monday, March 6

Life in the solar system, space travel

Monday, March 20

#### **The Martian**

Monday, March 27

Human mission to Mars, future exploration

Monday, April 3

Human mission to Mars, future exploration

Monday, April 10

#### **Interstellar**

Monday, April 17

Dust Bowl (Climate), Wormholes, Relativity

Monday, April 24

Dust Bowl (Climate), Wormholes, Relativity

Monday, May 1

**Project Due**, Climate, Wormholes, Relativity

Other possibilities include: **Contact** (Exobiology, humanity's response to contact) **Man Of Steel** (Alien planets, Terraforming), **Oblivion** (Cloning, Mass extinctions, Titan), **2012** (Quakes, Tsunamis, Neutrinos) **Star Trek** (Black Holes, Space Propulsion), **Deep Impact** (Asteroid Threat, Mitigation Plans) **Mission to Mars** (Human mission to Mars), **The Red Planet** (Terraforming, space propulsion), **The Day After Tomorrow** (Climate Change, Weather) **The Core** (Magnetic fields, Earth's interior), **Apollo 13** (History of NASA, Moon missions). **Passengers** (Deep Space Travel), **Arrival** (First Contact w/Life)

## **Research Essay Requirements**

### **Astronomy 30**

**Topic:** This paper should provide an overview of the science presented in a specific film that we viewed as a class or one that you decided to watch outside of class. Your in-depth analysis should examine the reality of the science presented and its value to the main message of the film. You might also go in depth on a specific topic in the film, story, or even science video game.

**Length: (~1500 words), 4-6** double spaced typed pages (or comparable amount of material completed in a different format), excluding figures and list of references.

**Sources:** Minimum three (3) sources other than encyclopedias and film. I encourage you to use the web or recent periodicals as sources. Many books will be out of date as the field of astronomy changes quite rapidly.

**Required:** Title page, Essay, References (citations), Reference List (bibliography).

**Due Date: Friday, May 5, 2023, by midnight on Canvas**

**Late Penalty: No late papers accepted.**

**Note:** **Bibliography** should be a list of all sources you have consulted with full information given about each. Normally this includes title, author, publisher, page numbers, year, etc. Internet sites should be listed with their site address (i.e. <http://www.....>). To simplify, you might list each site as site 1, site 2, etc., and then reference them in that way in the text of your paper.

You should directly **reference** any idea, fact, or quotation that is not your own or common knowledge (i.e. ‘the Earth is round’ does not need a reference). You are free to use any reference style you would like (MLA, APA). The simplest style includes the author’s name or title and the page number or the website (site 1, site 2, etc) following the referenced fact, quote, or idea in parentheses.

**An example:** The meteoritic impact in the Yucatan peninsula is believed to have led to the extinction of the dinosaurs. (Kring, 1993) or (site 1)

## **Gravity Questions**

1. Look at the history and accomplishments of the US space program, from Explorer to Apollo, to the Shuttle and the International Space Station. Look at future plans to land on an asteroid and eventually Mars.
2. Chronicle the history of the Russian space program from Sputnik to Laika to Soyuz and the Mir space station. What does the future hold?
3. Trace the history of the Chinese space program from the first launch to the first human flight to future plans for a space station and a trip to the moon.
4. Take a close look at the International Space Station, how big is it, who made it, how do they keep the crew safe, what do they eat?
5. George Clooney's character flies around in a space suit called a Manned Maneuvering Unit or MMU. What are the specifications on this device and how does it work?
6. NASA is in the process of developing a next generation space suit, what is new about it and how will it work? Where will it be used? Look at the history of and the evolution of spacesuits for Russia, China, and the United States.
7. Space debris is a major problem in the movie. How much orbital debris is up there? How do they track it? What plans do we have to clean up Earth orbit?
8. NASA is developing a new crew capsule and Rocket to follow the space shuttle. It is the Orion Crew Vehicle. How are they new and what stays the same from past capsules?
9. The company SpaceX delivers supplies to the space station with its Dragon Capsule and has plans to ferry astronauts with its Dragon V2 capsule. Examine them.
10. In the future, we may find ourselves in space looking for resources. What resources lie on the moon and the asteroids. What plans do we have to mine asteroids?
11. All capsules returning from space need a heat shield because of the extreme speed and thickness of our atmosphere. Look at the various heat shields on the Russian Soyuz capsules and the US Apollo, Space Shuttle, and Orion Capsules.
12. Bigelow aerospace is building an inflatable space habitat that NASA is interested in. How does it work and what does it look like?
13. Space tourism began with millionaires flying to the space station aboard Russian capsules for \$ millions. Richard Branson's Virgin Galactic will be flying folks into space on board Spaceship 2 from a spaceport in New Mexico for a fraction of the cost. Tell us about it.
14. Look at the "Kessler Effect" of the cascading number of collisions that would take place if one satellite were to hit another.
15. Discuss large waves like tsunamis created by earthquakes or impacts. What dangers do tsunamis pose to people and where are they the biggest threat.

## **Star Trek 2: Into Darkness Questions**

1. Discuss genetic engineering, past, present, and future possibilities. Perhaps look at how various traits that are viewed as desirable might be enhanced. What are the ethical concerns?
2. Discuss hibernation in animals. Might human beings one day hibernate? What about “suspended animation” for long duration spaceflights?
3. Talk about the emerging field of teleportation like the “transporters” in Star trek. What about quantum entanglement?
4. Discuss the superconducting supercollider/Large Hadron Collider. What is its scientific purpose? Can it produce antimatter like is used in the engines of the Enterprise. What is antimatter?
5. Might we one day travel faster than the speed of light? Look at the “warp drive” conceived of by Physicist Alcubierre. Might we use black holes or wormholes to bend space instead?
6. Look at the history of large volcanic eruptions like the Yellowstone volcano, Mount Pinatubo, Vesuvius, Krakatoa, and St. Helens. Chronicle their destructive power.
7. How can a volcano knock out an entire species as Kirk was worried about. Look at climate change associated with ash clouds and a “volcanic winter”. Has this ever happened on Earth? Discuss pyroclastic flows.
8. Spock tries to shut down the volcano using a “cold fusion” device. What is cold fusion? What is normal fusion? Look at the work at the National Ignition Facility.
9. Kahn’s cells are useful for cell regeneration and to reverse the aging process. What is the state of research into increasing the longevity of a human life? How has lifespan changed over the centuries?
10. Star trek makes use of lasers and phasers? Where is the state of research on lasers both as weapons and for medicine and other uses. What about particle beams?
11. Life forms on other planets take on a large number of forms. Look at a wide range of extremophile organisms living in extreme environments on Earth as possible extraterrestrial organisms. Look at “water bears”.
12. Star trek visits lots of Earth like planets. Take a look at some of the terrestrial planets orbiting other stars discovered by the Kepler Space Telescope. You might look at the worlds Kepler 186f or Kepler 10c as examples.
13. The Enterprise starts the movie underwater, how deep can submarines, submersibles, and diving suits go? What temperature extremes can spacesuits withstand?
14. The smuggler’s ship runs on fuel cells. What are they? How much power do they produce? What is their fuel & waste product? Are they used by NASA? Or in cars?

## **Europa Report Questions**

1. Look at the history of long duration spaceflights. Who has the record for longest time in space? Briefly look at the health risks of zero gravity.
2. What is the farthest out that any human made spacecraft has gone. Look at both of the voyager missions. Give a brief description of their achievements along with a look at the “golden record”.
3. Look at the history and engineering of spacesuits from their inception to modern suits and what the future holds.
4. Discuss the range of extremophile lifeforms that have been discovered on Earth and under what conditions they exist. Is there life in Lake Vostok?
5. Discuss volcanic vents on the ocean bottom, so called black smokers. Look at both their geology and the lifeforms that exist there.
6. Discuss bioluminescence, how it works, what creatures use it, and what do they use it for.
7. Discuss what we currently know about Jupiter’s moon Europa. What do the models suggest about its oceans and its surface? What heats it? Why is the surface a high radiation environment?
8. Take a close look at Jupiter’s moon Io.
9. Take an in-depth look at Jupiter’s moons Ganymede and Callisto.
10. Look at the important findings of the Galileo space mission to Jupiter.
11. Discuss the Juno mission to Jupiter.
12. Look at Europe’s planned 2023 mission named the JUPiter ICy moons Explorer (Juice) and its goals and objectives.
13. Talk about the field of Exobiology. What about the theory of panspermia? How does NASA make sure there are no unwanted microbes on our space probes?
14. Talk about rotating a spaceship to create artificial gravity. Is it feasible? How fast will it rotate? How big must the ship be? Could they use a tether with two ships?
15. Look at Lake Vostok in Antarctica and the efforts to drill under the ice into it. What did they find? Also, look at the deepest areas of the Earth’s oceans and what submersibles have found there.

# **The Martian**

1. What are NASA's plan for a human mission to Mars. Look at the timeline that includes a 6 month trip out, a year and a half on the surface, and a six month trip back. When might we go? You might look at Robert Zubrin's Mars Direct plan or the privately funded Mars One trip planned for 2023+.
2. How will the U.S. or the world pick a crew to go to Mars? What will the make-up look like? How many? What nationalities/gender? What skills will each of the astronauts need to have?
3. What does the surface of Mars look like? Look at pictures from Viking, Mars Pathfinder, the Mars Exploration Rovers, and the Mars Curiosity Rover. What have these missions found in terms of the geologic past of Mars.
4. Discuss the findings and the landing method for the Mars Pathfinder lander and the Sojourner rover that arrived at Mars in 1997 and were dug up for use as a communication link in the movie.
5. Take a look at the Martian atmosphere and the weather on Mars. Talk about the global dust storms. What about dust devils, lightning, and the sublimation of the Carbon Dioxide in the polar caps during the summer?
6. Talk about rotating a spaceship to create artificial gravity. Is it feasible? How fast will it rotate? How big must the ship be? Could they use a tether with two ships?
7. Talk about the Biosphere 2 project as a proxy for a Mars habitat. Look at its history and results. Look at growing vegetation with hydroponics. There is a mock Mars habitat project in Hanksville, Utah. Discuss its value.
8. Is it possible to make water from Hydrazine rocket fuel? Explain the process from the movie.
9. Talk about the use of gravity assists or "gravitational slingshots" spacecraft have used to change orbits with little fuel use. Examples might include Voyager 2, New Horizons at Jupiter, and the Apollo 13 crew return.
10. Talk about the use of RTGs on Mars as a heat and power source. How does this nuclear power source work on the Curiosity rover?
11. Look at NASA's next generation "Orion" crew vehicle and proposed Space Launch System rocket as part of the Artemis program and the Lunar Gateway Space Station. How does SpaceX's Dragon capsule, Falcon rockets, and Starship fit into the mix?
12. Look at inflatable habitats for space stations and on planetary surfaces.
13. Discuss the possibility of liquid water on the surface of Mars today in light of recent discoveries.
14. Talk about tests done and theories of making methane/oxygen rocket fuel from the Martian atmosphere. The Mars Society and Robert Zubrin (Mars Direct) talks about the fuel production process. Also, look at NASA's plan to use this on a sample return mission in the near future.
15. Look at the long term physiological effects of weightlessness? Does exercise work to lessen the effects? What have astronauts found during space station exercise studies? Who has the record for the longest time in space?
16. What do we need to make soil and grow things on a planet's surface?



## **Interstellar Questions**

1. Discuss the Dust Bowl and its relation to farming practices of the early 1900's.
2. Discuss the overall predictions from the IPCC about the short and long term issues created by climate change for sustainability on planet Earth.
3. Look at the use of non-piloted drones with both military and non-military applications. What nations are using them?
4. Look at world food production. What is the long term prognosis for feeding the world? What is the carrying capacity of this planet?
5. Did we really land on the moon? What do the conspiracies say and why? What does NASA say?
6. Talk about large dust storms on the Earth and especially on the planet Mars.
7. What causes the tides on Earth? Where are the tides the greatest (e.g. Bay of Fundy). What were the tides like billions of years ago when the Moon was much closer?
8. Look at the state of Artificial Intelligence and Robotics. Where are we headed?
9. Take a close look at Saturn's rings and the dynamics within them particularly with data from the Cassini Mission.
10. Look at relativity and time dilation. How does it work? Is time travel possible?
11. Look at the use of gravitational slingshots to accelerate spacecraft as well as aerobraking to slow them down.
12. What is the speed of Gravity? What are gravity waves? Look at the space mission Gravity Probe B.
13. Talk about wormholes as gateways to other parts of space. How many dimensions are there thought to be? How can we interact with or study them?
14. Look at Black holes, rotating black holes, singularities, and the effects of crossing the event horizon. How do black holes form? How big or small can they be?
15. Talk about the physics of a rotating spacecraft to generate artificial gravity. Has it been done? How fast would it have to spin?
16. Look at long duration spaceflight with suspended animation and/or hibernation techniques.